

WHAT IS CLAIMED IS:

- 1                   1.     A method for depositing a film on a substrate in a process chamber,  
2     the method comprising:
  - 3                   (a)     flowing a process gas comprising a plurality of precursor gases  
4     suitable for forming a plasma into the process chamber; and
  - 5                   (b)     generating a plasma from the process gas to deposit the thin film on  
6     the substrate,  
7                   wherein the plurality of precursor gases are flowed into the process  
8     chamber such that the thin film is deposited at a center of the substrate more rapidly than  
9     at an edge of the substrate.
- 1                   2.     The method according to claim 1 wherein the film comprises a  
2     silicon oxide.
- 1                   3.     The method according to claim 2 wherein the plurality of precursor  
2     gases comprises a silane and a gas that contains oxygen.
- 1                   4.     The method according to claim 3 wherein the process gas further  
2     comprises an inert gas.
- 1                   5.     The method according to claim 4 wherein the inert gas is argon.
- 1                   6.     The method according to claim 1 wherein the process chamber  
2     comprises a top gas source and a side gas source and wherein at least one of such  
3     precursor gases is flowed through the top gas source at a higher rate than through the side  
4     gas source.
- 1                   7.     The method according to claim 6 wherein every such precursor gas  
2     is flowed through the top gas source at a higher rate than through the side gas source.
- 1                   8.     The method according to claim 7 wherein every such precursor gas  
2     is flowed only through the top gas source.
- 1                   9.     The method according to claim 1 wherein the process gas further  
2     comprises an inert gas.
- 1                   10.    The method according to claim 9 wherein the inert gas is argon.

1                    11.     A method of depositing a film over a substrate disposed in a  
2 chamber of the type having a first set of gas nozzles positioned to provide a flow of gas at  
3 a periphery of the substrate and a second nozzle positioned to provide a flow of gas above  
4 an upper surface of the substrate, the method comprising  
5                    (a)     flowing a process gas into the chamber through the first set of gas  
6 nozzles and through the second nozzle during first and second periods; and  
7                    (b)     forming a plasma from the process gas to deposit a film over the  
8 substrate during the first and second periods,  
9                    wherein a flow ratio of the process gas provided from the second nozzle  
10 relative to the first set of nozzles is greater during the second period than during the first  
11 period.

1                    12.     The method according to claim 11 wherein the film comprises a  
2 silicon oxide.

1                    13.     The method according to claim 12 wherein the film is deposited  
2 over an intermetal conductive layer.

1                    14.     The method according to claim 12 wherein the second nozzle  
2 comprises a pair of nozzles.

1                    15.     The method according to claim 14 wherein a silicon-containing gas  
2 is provided through one of the pair of nozzles and an oxygen-containing gas is provided  
3 through another of the pair of nozzles.

1                    16.     A method for etching a substrate in a process chamber, the method  
2 comprising:

3                    (a)     flowing an etchant gas into the process chamber; and  
4                    (b)     generating a plasma from the etchant gas to etch the substrate,  
5                    wherein the etchant gas is flowed into the process chamber at a higher  
6 flow rate above the substrate than at a periphery of the substrate.

1                    17.     A computer-readable storage medium having a computer-readable  
2 program embodied therein for directing operation of a substrate processing system  
3 including a process chamber; a plasma generation system; a substrate holder; and a gas  
4 delivery system configured to introduce gases into the process chamber, the computer-

5 readable program including instructions for operating the substrate processing system to  
6 deposit a thin film on a substrate disposed in the process chamber in accordance with the  
7 following:

8 (a) flowing a process gas comprising a plurality of precursor gases  
9 suitable for forming a plasma into the process chamber;; and

10 (b) generating a plasma from the process gas to deposit the thin film on  
11 the substrate,

12 wherein the plurality of precursor gases are flowed into the process  
13 chamber such that the thin film is deposited at a center of the substrate more rapidly than  
14 at an edge of the substrate.

1 18. The computer-readable storage medium according to claim 17  
2 wherein the plurality of constituent reaction gases comprises a silane and a gas that  
3 contains oxygen.

1 19. The computer-readable storage medium according to claim 18  
2 wherein the process gas further comprises an inert gas.

1 20. The computer-readable storage medium according to claim 17  
2 wherein the process chamber comprises a top gas source and a side gas source, wherein  
3 the gas delivery system is configured to introduce gases into the process chamber through  
4 the top gas source and the side gas source, and wherein the computer-readable program  
5 further includes instructions to flow at least one of such precursor gases through the top  
6 gas source at a higher rate than through the side gas source.

1 21. A substrate processing system comprising:

2 (a) a housing defining a process chamber;

3 (b) a high-density plasma generating system operatively coupled to the  
4 process chamber;

5 (c) a substrate holder configured to hold a substrate during substrate  
6 processing;

7 (d) a gas-delivery system configured to introduce gases into the  
8 process chamber;

9 (e) a pressure-control system for maintaining a selected pressure  
10 within the process chamber;

11                   (f)     a controller for controlling the high-density plasma generating  
12 system, the gas-delivery system, and the pressure-control system; and  
13                   (g)     a memory coupled to the controller, the memory comprising a  
14 computer-readable medium having a computer-readable program embodied therein for  
15 directing operation of the substrate processing system, the computer-readable program  
16 including  
17                   (i)     instructions to control the gas-delivery system to flow a  
18 process gas comprising a plurality of precursor gases suitable for forming a plasma into  
19 the process chamber; and  
20                   (ii)    instructions to control the high-density plasma generating  
21 system to generate a plasma from the process gas to deposit a thin film on the substrate,  
22 wherein the plurality of precursor gases are to be flowed into the  
23 process chamber such that the thin film is deposited at a center of the substrate more  
24 rapidly than at an edge of the substrate.

1                   22.    The substrate processing system according to claim 21 wherein the  
2 plurality of precursor gases comprises a silane and a gas that contains oxygen.

1                   23.    The substrate processing system according to claim 22 wherein the  
2 process gas further comprises an inert gas.

1                   24.    The substrate processing system according to claim 23 wherein the  
2 inert gas is argon.

1                   25.    The substrate processing system according to claim 21 wherein the  
2 process chamber comprises a top gas source and a side gas source, wherein the gas  
3 delivery system is configured to introduce gases into the process chamber through the top  
4 gas source and the side gas source, and wherein the computer-readable program further  
5 includes instructions to flow at least one of such precursor gases through the top gas  
6 source at a higher rate than through the side gas source.